

## TECHNICAL PROPOSAL

An analog computer is more than just a grouping of amplifiers, potentiometers, integrators, multipliers, function generators, etc. It is a system designed to provide the operator with maximum flexibility in using these components to do simulation or mathematical analysis. Due to the importance of understanding the concept of the system, we would like to highlight for your consideration, the following points that make the Systron-Donner Computer Series, the newest and most flexible mathematical tool on the market.

### ±100 Volt Operation

Advantages of ±100 volt operation over a ±10 volt system include the following:

1. Compatibility and Slaving to other 100 volt systems.

The industry standard has been ±100 volts for many years and as such, most of the computers in use today are 100 volt.

2. Improved Accuracy and Resolution for non-linear functions.

For Multipliers and Function Generators where diodes are used, the higher the full scale range, the less effect the forward voltage drop characteristics of diodes have. The diodes have a constant voltage error and thus can represent ten times the error for a 10 volt system than a 100 volt system.

3. Signal-to-Noise Ratio Improvement.

Although 100 volt amplifiers typically have more noise than a 10 volt amplifier, it is usually less than a factor of 3 and therefore a 3 to 1 improvement of signal-to-noise can be obtained; i.e., a 10 m.v. peak-to-peak noise level is 80 db for a 100 volt system, but only 60 db for a 10 volt system.

4. No Obsolescence.

The industry standard will continue to be 100 volt and all future developments of significance will be made on 100 volt designs.

### Patchboard Simplicity

The patchboards for both the SD 10/20 and 40/80 have been carefully human-engineered for expert and neophyte alike. Very simply stated, "The visual computer circuits make it possible for the Programmer and Operator to be one".

This unique patchboard is ideal for the installations where the computer operator must also do the programming. With the computer circuit very clearly shown, it eliminates the need for memorizing special patching codes or utilizing special and expensive patching cords.

For scientific education, the "circuit approach" on the patchboard provides the student with a direct comparison between programming and the circuits in the text book.

### Built-In Hybrid Capability

Three Digital Logic Modules provide hybrid computation as a standard part of the computer.

The design concept of the SD Computer provides the necessary mode control -- flexible Rep-Op capability -- relay and electronic switch comparator circuitry -- forward-reverse logic for all integrators - to make this a very simple expansion.

These digital modules add the flexibility to achieve complete sub-routine control for "Integrator Mode". The unique digital counter can be used as a pre-set timer with multiple outputs, a pre-set event counter with multiple outputs, or a combination of both.

### Outstanding Features

- No Increase in Size

  - No separate housing required

  - No separate patch board required

- Computer Can Still be Fully Loaded (using QUAD Summer)

- Light for each Flip-Flop (located at Flip-Flop)

- Flexible Timing

  - Each command variable in selected increments to 1000 secs.

- Pre-Set Event Counter

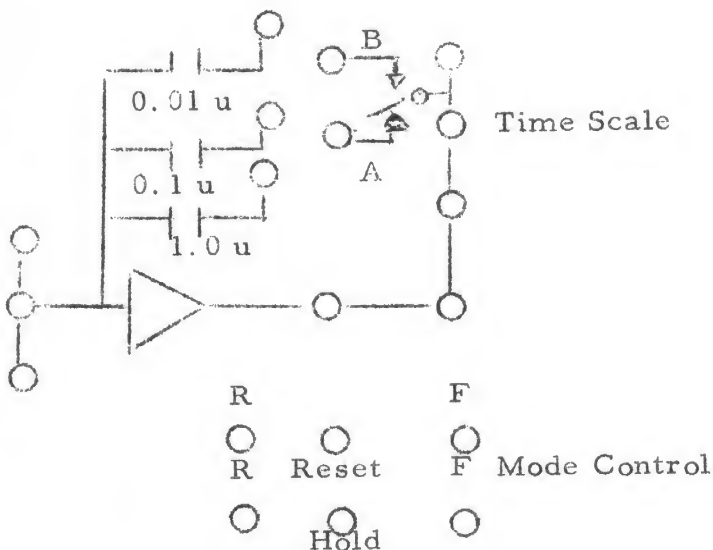
  - Up to 6 decades

The S/D-1 LOG Digital Logic Control Modules follow the same philosophy as the other modules. By using the Model 3325 Quad Summer in conjunction with the various digital logic units, digital capacity in excess of that offered by competitively priced computers, can be provided while maintaining the full amplifier capacity.

Not only can a greater number of flip-flops and logic gates be provided, but a much more flexible time event control is offered. The Model 3328 incorporates a crystal controlled 1 Kc output and can be patched, using up to six decade dividers to provide an unlimited number of outputs in 1 ms steps to 999 seconds. The same decade divider arrangement can provide the same range of outputs as a function of events within the program, such as Max-Min and inflection points. Since the six decade dividers are independently patchable, there is complete flexibility of use between event and timer dividers. This flexible unit, in conjunction with the Model 3327 logic gates and the Model 3326 flip-flops, provides control capability that is only limited by the imagination of the user.

#### Programming - Module Flexibility

S-D 40/80 The Model 3320 is our Dual Integrator module. On the problem board we have the following layout:



S-D 10/20 The Model 3329 QUAD Integrator provides the same patching flexibility when used with the Model 3325 QUAD Summer.

- a. Time Scale Mode: The feedback capacitors are in an oven and give you a .01% computing capability.
- b. In our concept, we offer time scale selection independent of computer mode control.
- c. The selection of time scale is normally controlled by a switch on the console marked "Time Scale A-B", also it can be controlled automatically by the problem.
- d. Let's look for a second at the patching flexibility that the operator has for time scale. We can patch a 10th  $\mu$  to Point B; a 1  $\mu$  to Point A; or for some integrators, a 1  $\mu$  to Point B and a 10th  $\mu$  to Point A; or even have other integrators with the feedback capacitor patched around the time scale selector switch.

As you can see from this selection of patching, the operator has complete control, either manually or automatically, of time scale during a problem solution.

- e. In the integrator mode control, we use high-speed reed relays. The top of the relay coil for the reset and hold relays is terminated at the board next to each integrator. On either side of these terminations, we terminate for patching purposes the reset and hold bus. Therefore, with a simple patch you can put the integrator in any mode: Computer, Reset, Hold, Track and Store, etc., during any part of the problem mode. This type of arrangement allows the operator to program for the most complex iterative problem program. He also has the complete flexibility to do any kind of complicated subroutine within a Rep-Op or Real Time computation.
- f. The operator can also simply patch the integrator so that its mode control is done by electronic switches rather than the high-speed relays. With electronic mode control, the operator now has all of the flexibility to solve problems involving high speed iteration or Rep-Op.
- g. High speed repetitive operation is provided as a standard feature of the S-D Computers. Continuously adjustable control of compute time is provided from 5 msec to 10 seconds. The reset period in the S-D 40/80 is continuously adjustable in the range from 5 msec to 5 seconds. This control, in conjunction with the high speed reed relays of the computing modules, provides repetitive operation speeds up to 100 cps. There is full flexibility in the selection of time scale for any of the combinations of compute and reset time. This flexibility allows full use of the high accuracy integrator capacitors for improved computational results. By using the Model 3324 modules, repetitive operation speeds up to 1 Kc can be provided.

## OTHER FEATURES

We have static and dynamic problem check. (S-D 40/80 only)

Without removing any patch cards, you can:

- Check all patching,
- Check all IC's,
- Check all integrator timing as used in the problem.

In the S-D 40/80 and S-D 10/20 --

You receive a complete digital address system.

You have three different time scale selections that are independent from the compute mode and can be programmed independently for each integrator.

Our standard integrator can be used with electronic mode control for high speed Rep-Op and can be programmed in a forward or reverse mode.

Computing modules can be placed anywhere in the system by the user without any modification to the system.

We have nine different computing modules on the market, with seven more in their final stages of development. Within a year we will have more than twenty different computing modules designed for the system so that the customer can add them without any changes to the computer. In the enclosed literature, you will find a complete selection of computing elements --

|                     |                     |                  |
|---------------------|---------------------|------------------|
| Integrators         | Function Relays     | Comparators      |
| Summers             | Multipliers         | Event Counters   |
| Inverters           | Dividers            | Clock Counters   |
| Function Generators | Electronic Switches | RST Flip-Flops   |
|                     |                     | Electronic Gates |

--- With more to come (emphasizing cost, accuracy, and computing capability, digital and analog).

## Expansion Capabilities

|           |                          |
|-----------|--------------------------|
| S-D 40/80 | Expands to 84 Amplifiers |
| S-D 10/20 | Expands to 20 Amplifiers |